California
Energy Commission
Research & Development

Wildfire: Assessing and Preparing for Risks under Climate Change

Request for Comments on a Draft Solicitation

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Energy Research and Development Division

November 5, 2018
Sacramento, CA

Webinar Objectives

- Provide background on previous studies, and research gaps
- Introduce the draft Grant Funding Opportunity (GFO) solicitation
  - Explain relationship of this GFO to potential future research on preventing utility-caused ignitions
- Solicit oral and written comments from interested parties on discussion questions about the planned grant solicitation

The EPIC Initiatives

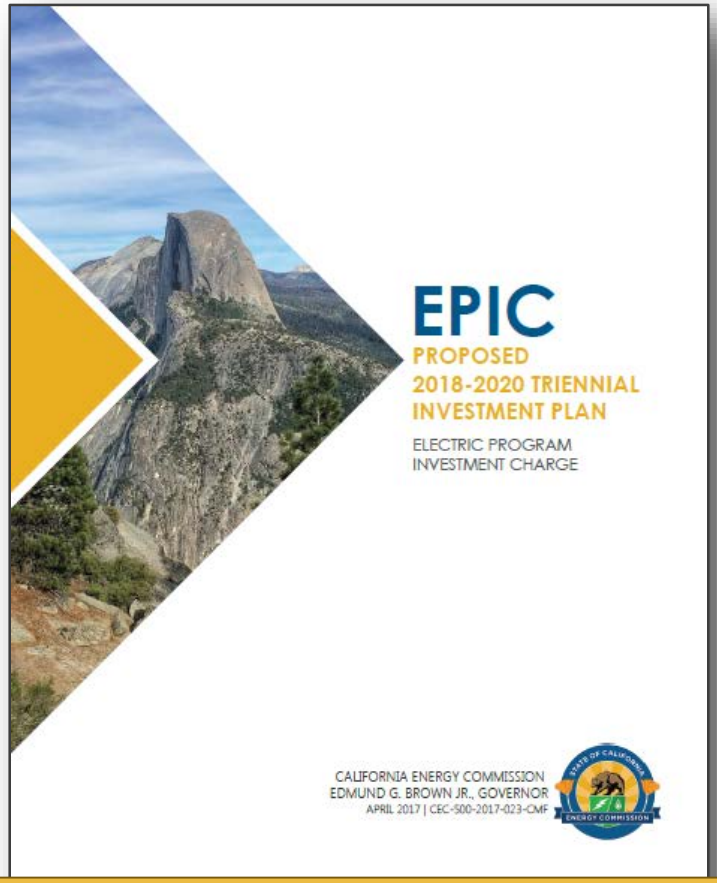
Sub-Theme 7.2 Increase the Resiliency of the Electricity System to Climate Change and Extreme Weather Events

Initiative 7.2.1 Improved Understanding of Climate- and Weather-Related Risks and Resilience Options

- Build climate projections that shed light on parameters of interest to California's electricity system
- Develop probabilistic projections that can provide a basis for better seasonal and decadal planning

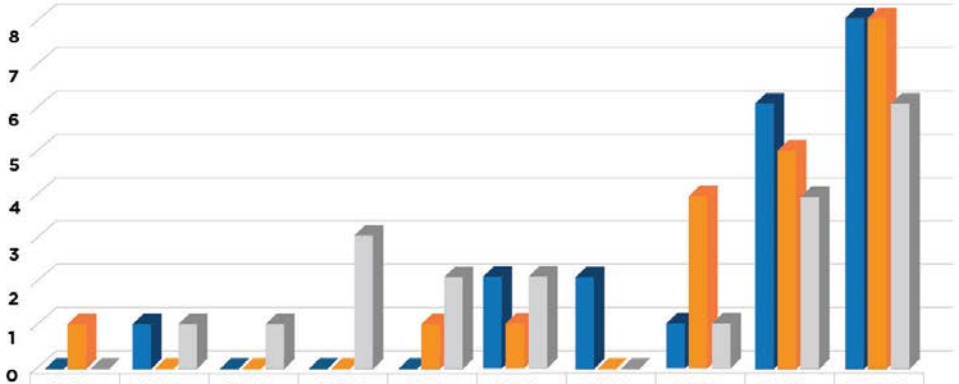
Initiative 7.2.3 Integrate Climate Readiness into Electricity System Operations, Tools, and Models

- Provide tools that feed directly into management and strategies



www.energy.ca.gov/research/annual_reports.html

The Largest, Most Destructive, and Deadliest California Wildfires in the Last Century…



	1918-1927	1928-1937	1938-1947	1948-1957	1958-1967	1968-1977	1978-1987	1988-1997	1998-2007	2008-2017
Largest	0	1	0	0	0	2	2	1	6	8
Most Destructive	1	0	0	0	1	1	0	4	5	8
Deadliest	0	1	1	3	2	2	0	1	4	6

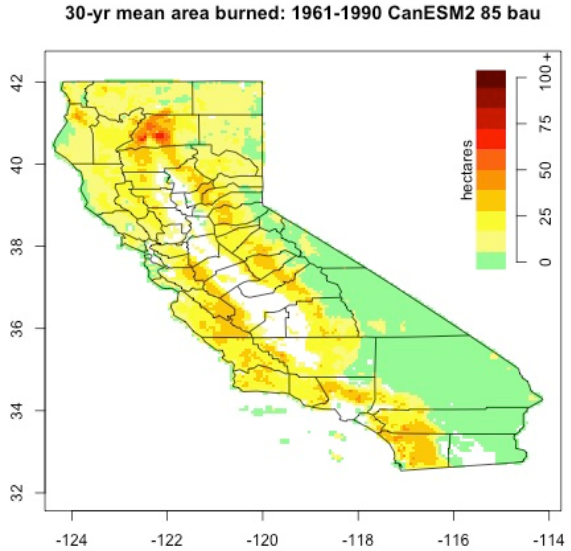
Source: California Energy Commission using data from http://cdfdata.fire.ca.gov/incidents/incidents_statsevents

…and Worse Could Come

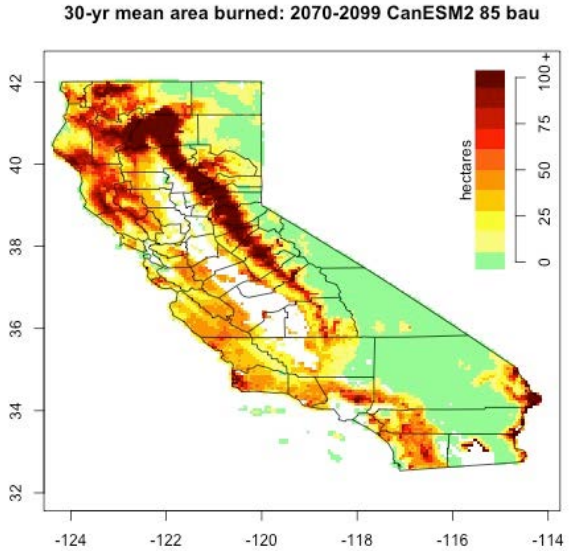
Source: California's Fourth Climate Change Assessment

Large Wildfires Projected to Become More Frequent with a Warming Climate (Fourth Assessment)

Historical area burned per year

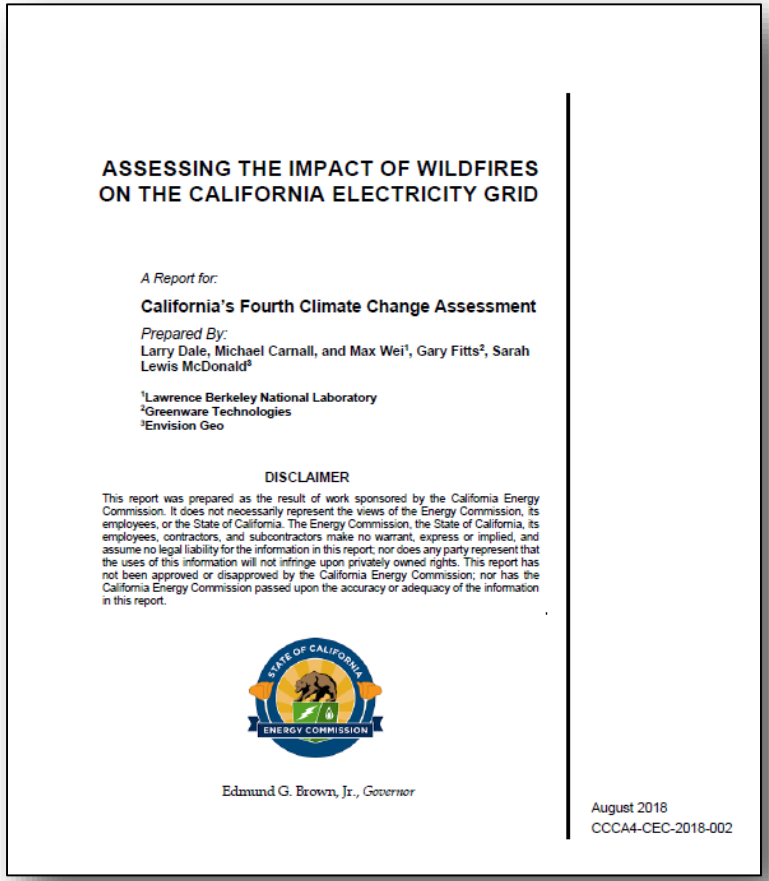


Projected



Source: Westerling, Anthony Leroy. (University of California, Merced). 2018. Wildfire Simulations for California's Fourth Climate Change Assessment: Projecting Changes in Extreme Wildfire Events with a Warming Climate. California's Fourth Climate Change Assessment, California Energy Commission. Publication Number: CCCA4-CEC-2018-014.

Grid Vulnerability to Wildfire



ASSESSING THE IMPACT OF WILDFIRES ON THE CALIFORNIA ELECTRICITY GRID

A Report for:

California's Fourth Climate Change Assessment

Prepared By:

Larry Dale, Michael Carnall, and Max Wei[1], Gary Fitts[2], Sarah Lewis McDonald[3]

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[2]Greenware Technologies
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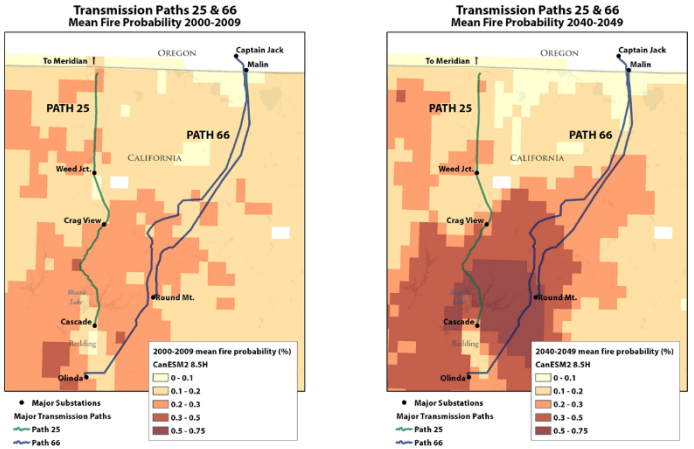
Edmund G. Brown, Jr., *Governor*

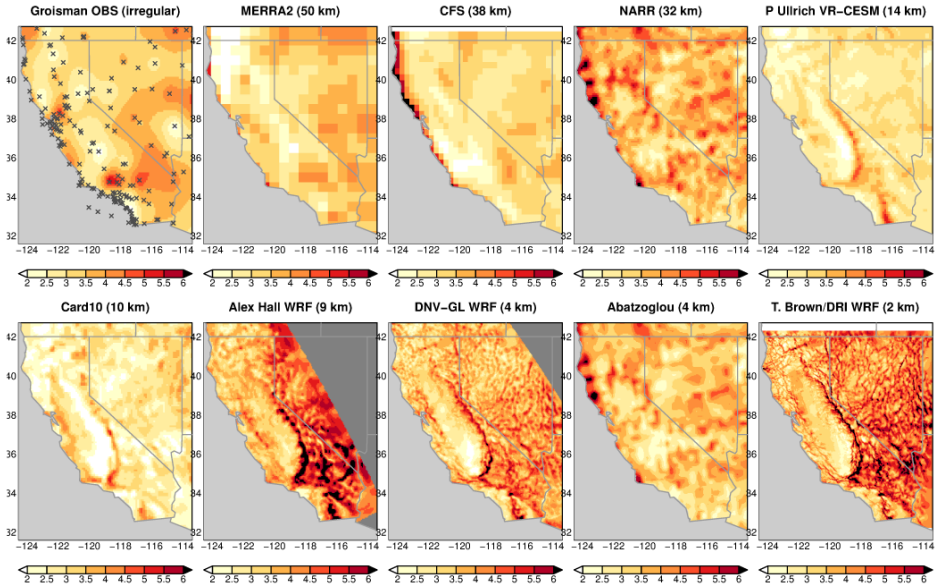
August 2018
CCCA4-CEC-2018-002

- Assessed vulnerability of the transmission and distribution systems historically and with climate change
- Used the UC Merced fire scenarios



Source: Dale et al. 2018. Assessing the Impact of Wildfires on the California Electricity Grid. California's Fourth Climate Change Assessment, California Energy Commission. Publication number: CCCA4-CEC-2018-002.

Scripps is developing a hybrid downscaling approach for climate parameters (incl. wind)



Source: Cayan and Pierce, 2018

- Historical wind data sets do not agree with each other. The future of extreme wind events is a major uncertainty.
- Basic problem is lack of training data for statistical model.
- Generate training data with a dynamical model, downscale with statistical.
- Several applications require vector wind (speed & direction).

July 25, 2018, Staff Workshop

A staff workshop was held to solicit stakeholder comments to learn about the research needs on grid resilience to wildfire and ignition prevention. https://www.energy.ca.gov/research/notices/#07252018

Grid Resilience and Climate Adaptation

- The workshop featured researchers studying potential impacts of tree mortality on wildfire and better characterizing extreme wind events
- This is the focus of this draft GFO

Ignition Prevention and Utility System Vegetative Intrusion Detection and Suppression

The workshop featured a panel discussion with utilities and other agencies about their related activities and research needs

- IOUs and others recommended forming a research working group (first working group meeting held October 16)
- This may be the subject of a future GFO

Research Gaps for Grid Resilience

- Improving the understanding of wildfire risk and behavior during extreme weather events, following tree mortality, and in the Wildland-Urban Interface
- Synthesizing the latest findings from fire and climate science into fire risk assessment for both near-term operations (situational awareness) and long-term planning
- Identifying vulnerable grid and other critical assets

What are the goals of the GFO?

- Advance wildfire science to support improved grid resilience
- Incorporate that new knowledge to develop and demonstrate advanced techniques and tools that can improve the assessment of risks to the electrical infrastructure from wildfire now and with a changing climate
- Develop models and analytics that can feed directly into utility management and planning
- Conduct foundational research in anticipation of California's Fifth Climate Change Assessment

Relationship of Research Topics/Phases

Phase I

1) Develop new information and knowledge about fire behavior in extreme weather
   a) Spatial optimization modeling for configuring weather station network
   b) Physical simulation of burning after tree mortality
   c) Analysis of historical fire behavior in extreme wind events

2) Develop computationally efficient fire spread models and analytics

3) Develop long-term wildfire scenario models (Fifth Assessment)

Phase II

Run or transfer wildfire spread models and analytics

Run long-term wildfire scenario models (Fifth Assessment)

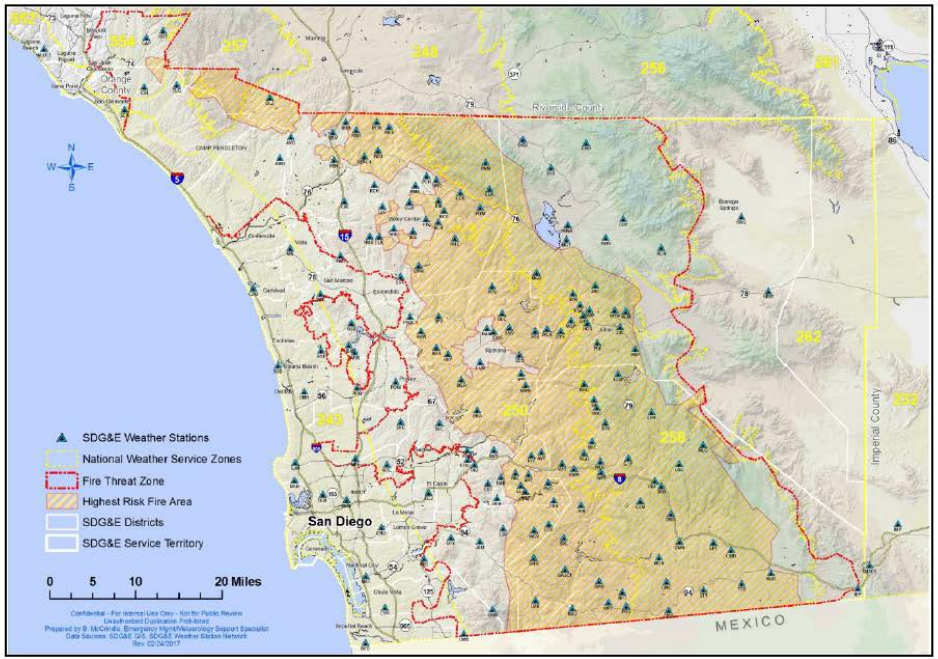
Improved Real-Time Weather Information

- "…the immeasurable value gained from the geospatially precise, high resolution data collected by the proposed weather stations. The potential uses for such data are endless and the public benefit provided by its implementation and potential scientific advancement towards better understanding the effects of climate change on California's landscape is immense." (p. 26)
- "…encourage studies for potential uses of such high-quality weather data to develop and implement operational and predictive tools that enhance utility situational awareness…" (p. 3)

CPUC Safety and Enforcement Division. 2018. Rulemaking 15-05-006: SED-CAL FIRE Joint Assessment and Recommendation Report.

1a. Model an Optimal Statewide Weather Station Network

SDG&E Weather Network: 170 Weather Stations



Source: San Diego Gas & Electric

Where could new weather stations be deployed to optimize the value of the information for forecasting wildfire risk to the grid?

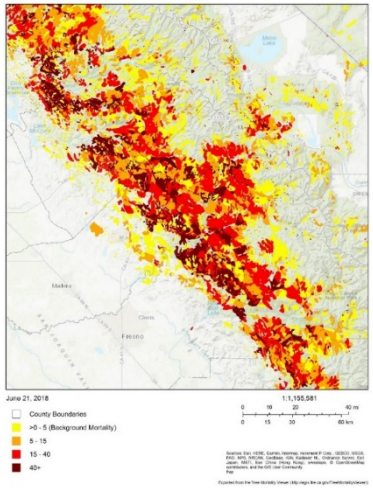
How Will Tree Mortality Affect Wildfire Risk?

Quantifying theoretical risk

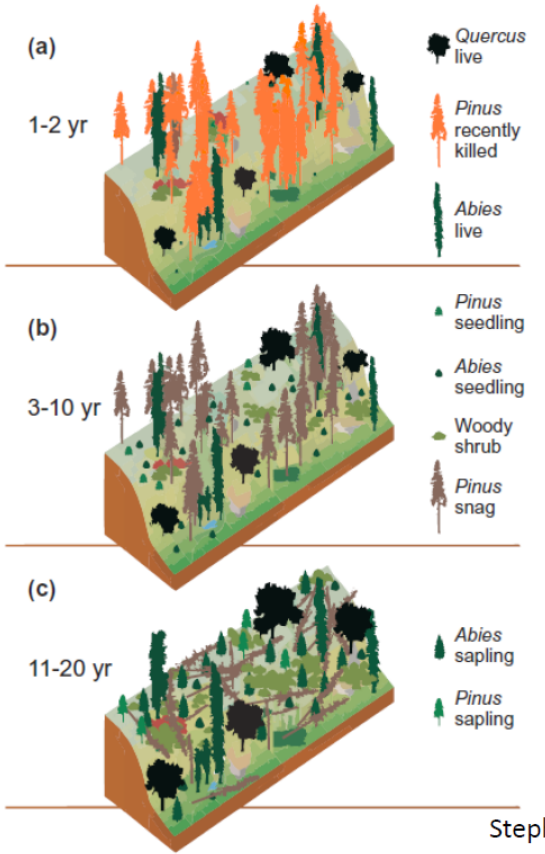
The scale of present tree mortality is so large that greater potential for "mass fires" exists in the coming decades…

Stephens et al. 2018
Bioscience

But we lack historical data for California to test the hypothesis



Tree Mortality Viewer
Source: CALFIRE



Stephens et al. 2018

1.b. Physical simulation of burning after tree mortality

Photo credit: Missoula Fire Sciences Laboratory, https://www.firelab.org/project/burning-rate

Conduct simulated burning to mimic how dead surface fuels might burn to help parameterize new wildfire models

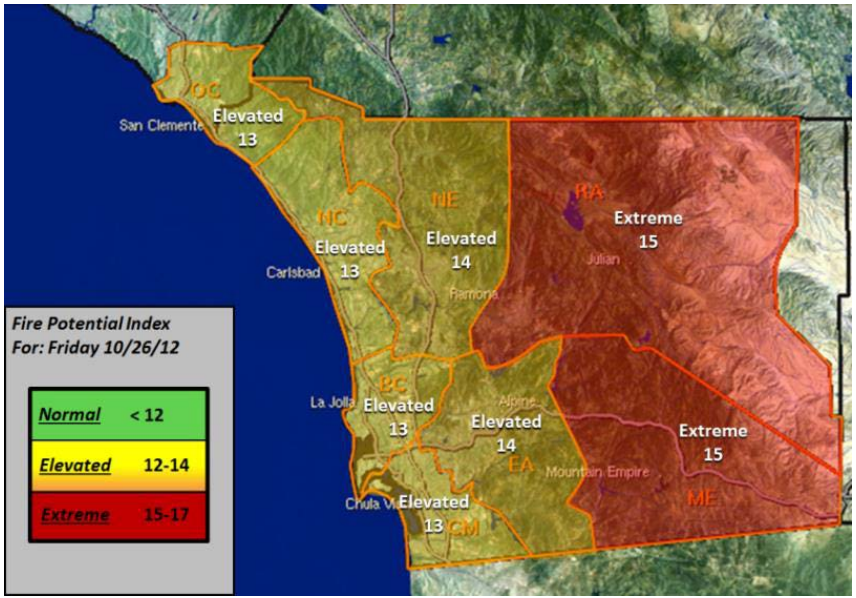
1.c. Analysis of historical fires and weather

Analyze past extreme weather events and the resulting fire behavior throughout the state to increase the ability to predict future fire risk

- Analyze fires in chaparral, coastal woodlands, and Sierran conifer forest
- Supercomputing/Big Data challenge

2. New Fire Risk Models and Analytics

Fire Potential Index



Example of the Fire Potential Index Map
Source: SDG&E

Fire risk assessment

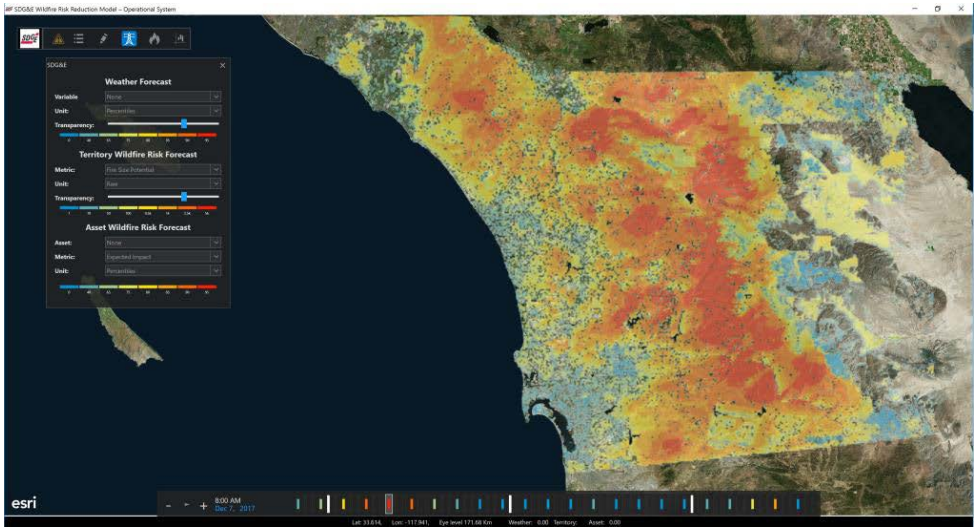
- Develop daily and near-term (out to 7 days) situational awareness analytics (e.g., Fire Potential Index)
- Incorporate new knowledge and data—wind, tree mortality, WUI
- Adapt to other regions of California

2. New Fire Risk Models

Fire risk assessment

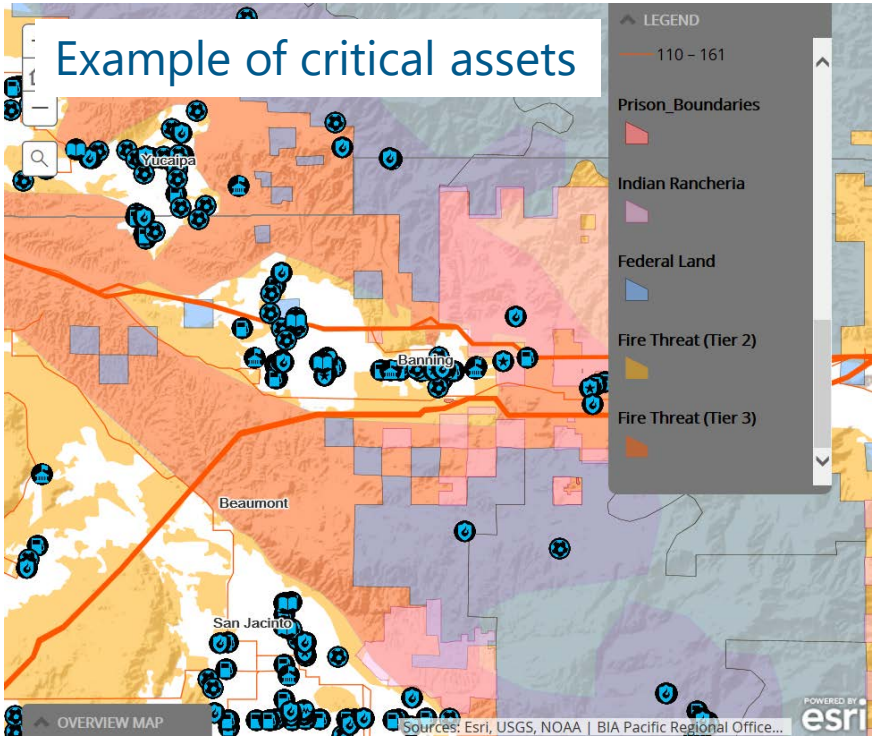
- Develop model to simulate the growth (spread) of fires under current or projected conditions to identify where grid is vulnerable daily (e.g., FireMap, WRRM OPS)
- Incorporate new knowledge from past and future weather conditions and fire spread in WUI into models
- Address the “big data” challenge —millions of simulations

Example of WRRM OPS output



Source: SDG&E

2. New Fire Risk Models



Energy Equity Indicators– Interactive Story Map, Fig. 26
Source: CEC

Models should support assessment of:

- Effects of proposed fuel treatments
- Vulnerability of critical assets

2. New Fire Risk Models

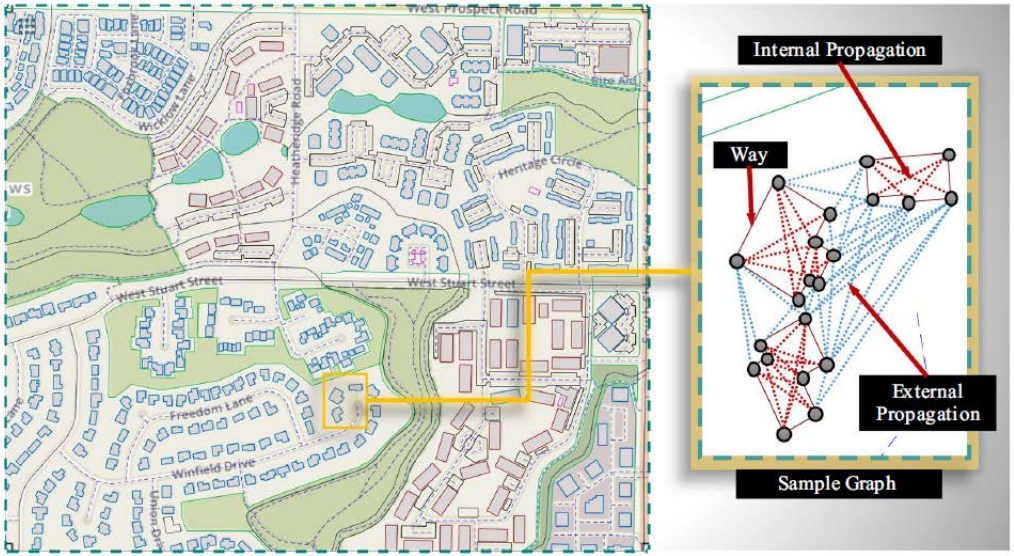


Figure 1. A sample representation of actual community layout (Fort Collins, Colorado, USA) as a graph network. The nodes of each way define its specific boundary and the edges represent the potential fire propagation paths (©OpenStreetMap contributors[55]).

Source: Mahmoud, H. and Chulahwat, A., 2018. Unraveling the complexity of wildland urban interface fires. *Scientific Reports*, 8(1), p. 9315.

Consider other types of fire risk models

- e.g., graph theory with lower computational load
- Grid assets could be modeled as nodes

2. New Fire Risk Models

Seasonal forecasting

- Most fire risk forecasts are daily or up to 7 days out based on near-term weather forecasts
- Investigate how probabilistic weather forecasts out to 6-9 months could be converted to wildfire risk forecasts
- Determine whether such seasonal probabilistic forecasts would be useful to IOUs and other stakeholders

3. Next Generation Wildfire Scenario Models

- Long-term fire scenario projection modeling (to mid- and late-century) driven by Scripps downscaled climate projections
- Incorporate latest science on extreme winds, tree mortality, vegetation change, and fire behavior in WUI
- Integrated with land use change modeling
- Develop and evaluate two or more approaches
- Foundational for 5th Assessment

Proposed EPIC Research Approach

- The Energy Commission intends to fund **one large, multidisciplinary project** with a very active technical advisory committee
- Phase 1 to fill knowledge gaps and develop state of the science wildfire models and analytics
  - 3-4 year program, $4 million
- Phase 2 to adapt and run wildfire scenario models for California's Fifth Climate Change Assessment and transfer local models to IOUs
  - Subject to performance and research priorities
  - $1 million

Next Steps

Step	Anticipated Date
Comment period ends	November 15
GFO released	Q4 2018
Applications due	Late Q1 2019
Notice of proposed award	Q2 2019
Agreement to Business Meeting	Late Q2 2019

Discussion Questions

- Do any of the topics unnecessarily duplicate research being done by others?
- Can any of the proposed topics be improved to have a greater impact? If so, which topic(s) and what specific suggestions would you make to improve the focus?

Discussion Questions (continued)

- Are there topics not included in the current set of concepts where this EPIC GFO could add significant value? What are the topic(s) and what research would be needed to have a measurable impact?
- How should IOUs be involved to ensure the science is actionable? Possibilities include:
  - Partners in crafting the solicitation (not eligible to apply)
  - Advisors on the technical advisory committee
  - Applicants for grants (not eligible to work on solicitation)
  - Partner on applications with other researchers as lead

Thank You!

Please submit your comments by November 15, 2018

- To website:
  https://efiling.energy.ca.gov/Ecomment/Ecomment.aspx?docketnumber=19-ERDD-01
- By email to the Docket Unit at:
  docket@energy.ca.gov
- By paper copy to the Docket Unit

Visit https://www.energy.ca.gov/research/notices/#11052018 to view the draft GFO

Questions?
Comments?